AMENDMENTS TO THE SPECIFICATION:

Please replace paragraphs 0005, 0006, 0010, 0012, 0013, 0018, 0021, 0024, 0026, 0027, 0035, 0038, 0041, 0042 and 0043 with the following, correspondingly numbered, amended paragraphs:

[0005] Frictional vibration is the principal cause of shudder, and the dependence of the friction coefficient on speed (the so-called "~~m-V~~ μ - V characteristic") is considered to have a strong influence on frictional vibration. Generally, the occurrence of shudder can be almost entirely avoided when the ~~m-V~~ μ - V characteristic curve, indicating the variation of the friction coefficient with speed, has a positive gradient, that is, increased friction in the high-speed range and decreased friction in the low-speed range.

[0006] Various ways have been proposed to provide a friction device with an ~~m-V~~ μ - V characteristic having a positive gradient. One proposal for improving the ~~m-V~~ μ - V characteristic was to increase the roughness of the surface of a friction mating member by barrel finishing to increase the friction coefficient in the high speed range. However, the friction coefficient in the low-speed range is highly dependent on the effect of the friction modifier (FM) contained in the lubricating oil, and the friction coefficient changes when the lubricating oil deteriorates or when the lubricating oil is changed. Thus, when the ~~m-V~~ μ - V characteristic is affected adversely by the lubricating oil, a

positive gradient in the ~~m-V~~ μ - V characteristic of a friction device cannot necessarily be achieved solely by increasing the friction coefficient in the high-speed range.

[0010] The ~~m-V~~ μ - V characteristics of the friction mating members mentioned in the above-identified patent documents are improved to some extent, but are still not entirely satisfactory. This invention addresses the foregoing problems. It is an object of the invention to provide a friction mating member having an improved ~~m-V~~ μ - V characteristic, in which the friction coefficient in the low-speed range is reduced without being affected by the type of lubricating oil or by deterioration of components of the lubricating oil, and in which the friction coefficient is increased in the high-speed range.

[0012] In a preferred embodiment of the invention, semispherical protrusions, having diameters in the range of 1 to 5 ~~mm~~ μm, are formed on the outer surface of the hard coating. The ratio of the area occupied by the protrusions to the total area of the outer surface of the hard coating is at least 3%, and the arithmetic average surface roughness Ra of the outer surface of the hard coating, excluding the semispherical protrusions, is in the range of 4 to 50 nm. On the other hand, the arithmetic average surface roughness Ra of the base member is preferably not greater than 0.07 ~~mm~~ μm. The thickness of the hard coating is preferably in the range from 1 to 20 ~~mm~~ μm, and in a preferred embodiment, the hard coating is formed of a composite material containing tungsten carbide and amorphous carbon.

[0013] Since the hard coating has a load point displacement characteristic in which the ratio of elastic deformation to maximum indentation depth, in a load range of 1 to 50 mN, is at least 50%, the friction mating member is capable of coping with both an increasing friction coefficient in the high-speed range, and a decreasing friction coefficient in the low-speed range, without being affected by the type of lubricating oil, or its deterioration. The coating maintains ~~an m-V~~ a μ - V characteristic, having a positive gradient, over a long period of use. By maintaining ~~an m-V~~ a μ - V characteristic having a positive gradient, the coating suppresses shuddering, and avoids problems resulting from noise and vibration.

[0018] FIG. 5 is a table showing the construction, frictional properties and ~~m-V~~ μ - V characteristics of friction mating members in an example of the invention and in four comparative examples, numbered 1 to 4;

[0021] FIG. 8 is a diagram showing friction coefficients of friction mating members in an example in accordance with the invention, and in comparative example 4 in a low-speed range, and the ~~m-V~~ μ - V characteristics of the friction mating members of the example in accordance with the invention and comparative example 4, for different types of lubricating oils.

[0024] The diameters of the semispherical protrusions are in the range of 1 to 5 ~~mm~~ μm. The friction member will be

abraded excessively if the semi-spherical protrusions 40 have diameters greater than 5 ~~mm~~ µm.

[0026] Preferably, the base member 30 has a surface having an arithmetic average surface roughness Ra not greater than 0.07 ~~mm~~ µm. When the base member 30 has a low surface roughness, the hard coating 20 is able to come into uniform contact with the friction member, and the sliding property of the hard coating 20 can be utilized fully, so that the frictional coefficient in the low-speed range can be reduced.

[0027] Preferably, the hard coating 20 on the surface of the base member 30 has a thickness in the range of 1 to 20 ~~mm~~ µm, and the surface of the hard coating 20, excluding the semispherical protrusions 40, has an arithmetic average surface roughness Ra in the range from 4 to 50 nm. With its surface roughness in this range, the hard coating 20 grinds the surface of the friction member slightly when the contact part 10 slides relative to the friction member. Consequently, the smoothness of the surface of the friction member is improved, the apparent contact area increases, a uniform, thin coating of oil is formed, and the friction coefficient in the high-speed range increases.

[0035] As shown in FIG. 5, the friction mating member in the Example according to the invention provided a large friction coefficient in a high-speed range, and a small friction coefficient in a low-speed range, and had a satisfactory ~~m-V~~ µ - V characteristic.

[0038] In a low-speed range, the friction mating member in Comparative example 3 provided a friction coefficient higher than that provided by the friction mating member in the Example according to the invention. However, it had an unsatisfactory ~~m-V~~ <u>μ - V</u> characteristic. This result was due to the high degree of surface roughness of the base member, its incapability of achieving uniform contact with a friction member, and insufficient utilization of the sliding property of the hard coating.

[0041] FIG. 8 is a diagram showing friction coefficients provided by the friction mating members in Example and Comparative example 4 in a low-speed range, and the ~~m-V~~ <u>μ - V</u> characteristics of the friction mating members in Example and Comparative example 4 for different types of lubricating oils. Lubricating oils A, B, C and D are those that are commercially available on the market. As is obvious from FIG. 8, whereas the friction coefficient provided by the friction mating member in Comparative example 4 in a low-speed range, and the coefficient of static friction provided by the friction mating member in Comparative example 4, are dependent on the type of the lubricating oil and are greatly dependent on temperature, the friction coefficient provided by the friction mating member of the Example in accordance with the invention is almost entirely independent of the type of the lubricating oil and temperature.

[0042] The friction mating member, formed by providing the surface of the base member with a hard coating having a load point displacement characteristic in which the elastic range,

in a load range of 1 to 50 mN, is at least 50%, is capable of coping with both increasing friction coefficient in a high-speed range and decreasing friction coefficient in a low-speed range without being affected by the type and deterioration of the lubricating oil. It is also capable of maintaining ~~an m-V~~ a μ - V characteristic having a positive gradient over a long period of use. The friction mating member of the invention suppresses shudder by maintaining a positive gradient in its ~~m-V~~ μ - V characteristic, and thereby solves problems attributable to noise and vibration.

[0043] Since the ~~m-V~~ μ - V characteristic of the friction mating member of the invention is not dependent on the type of the lubricating oil, the friction mating member of the invention can be used in combination with any suitable lubricating oil. Since the friction mating member of the invention is capable of suppressing shudder, damping mechanisms incorporated into bodies and transmissions of vehicles can be omitted. Consequently cost reduction, resource conservation, and energy conservation, can be achieved.